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FUNGI EMPLOYING MUCILAGINOUS, UNDIFFERENTIATED HYPHAE THAT ENTRAP AND ASSIMILATE NEMATODES

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One of the least sophisticated and possibly most primitive of devices employed by fungi to entrap nematodes and small invertebrates is that of mucilaginous hyphae to which nematodes and other small invertebrates adhere upon contact.

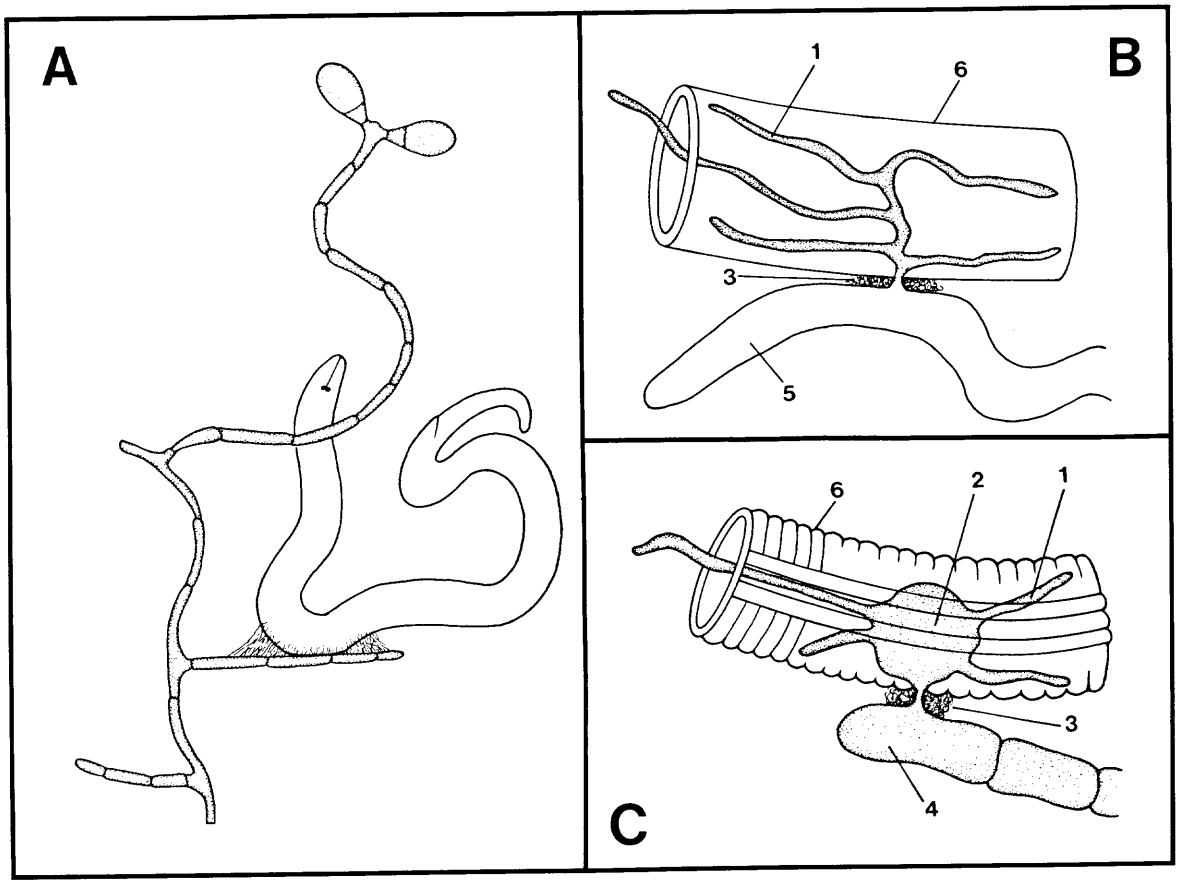

Fig. 1. A: A nematode adhering to a branch of Genicularia sp. B: Assimilative hyphae produced by aseptate mycelium. C: Assimilative hyphae produced by septate mycelium. 1) Assimilative hyphae; 2) Post-penetration bulb; 3) Adhesive pad; 4) Septate hyphal branch; 5) Nonseptate hyphal branch; 6) Nematode body section. (Redrawn from Estey & Tzean (6)).

Characterization:

Sticky hyphae develop and elongate through a substrate apparently without adhering to mineral or organic components in the substrate. If a nematode or other small invertebrate contacts a hypha, a clear sticky secretion is produced at the point of contact by the fungus which bonds the prey to the fungus (Fig. 1-A). The clear secretion may turn yellow, appearing in some cases, for example in Cystopage lateralis Drechs., as a sizable golden-yellow adhesive pad (Fig.1-B,C,-3). Struggling to free itself, the prey usually becomes attached at two or more points on the hyphae. After one to 2 hours of struggling, the prey usually becomes immobile (2). An infection peg from the parent hypha penetrates through the adhesive pad and into the prey integument.

In forms with septate mycelia, the infection peg swells inside the body, forming an oval post-penetration bulb (1) (Fig. 1-C-2). Assimilative hyphae develop rapidly from this bulb and digest the body contents of the prey, usually within 24 hours (2). In aseptate mycelial forms, a post-penetration bulb is usually not formed (Fig. 1-B), and the infection peg produces assimilative hyphae directly. Immobilization and subsequent death occurs in a few hours or days following infection. Tridentaria implicans Drechs. produces a hyphal branch that loosely encircles the prey. Adhesion occurs at a distal part of the branch after which the branch tip touches the prey and pierces it with a penetration peg (4). Some forms such as Monacrosporium cianopagum (Drechs.) Cooke & Dicken. and Genicularia perpasta R. C. Cooke occasionally produce sparsely developed, 3-dimensional hyphal networks formed by anastomosis of branches growing closely together.

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Habitat: Most sticky fungi occur in soil, leaf litter, decaying wood, and moss.

Prey: Phytoparasitic nematodes have been reported trapped by Monacrosporium cianopagum (5). Most sticky fungi capture a variety of bacteriophagous nematode genera such as Plectus communis Butschlii (3). Table 1 shows the type prey preferred by sticky fungi.

Archaic Consideration: Several characteristics indicate the primitive nature of the mucilaginous hyphal trap as compared to the array of other trapping devices employed by predaceous fungi (e.g., sticky knob, 3-dimensional hyphal network, nonconstricting and constricting rings). 1) A relatively small number of genera and species of fungi trap nematodes using this device (Table 1), possibly as a result of losing prey to more sophisticated and, therefore, more successful trapping devices. 2) Rhizopods (amoebae), primitive invertebrates that move sluggishly and are easily captured, represent the principal prey of this group (Table 1). 3) Most fungi with sticky hyphal traps are aseptate, thus classified in a lower fungus taxon. On occasion, those aseptate trapping fungi that manage to catch a nematode are injured when the hyphae break due to the struggling prey. More advanced fungi with sticky hyphal traps tend to separate at the septa, causing less damage to the hypha (7). 4) Certain sticky hyphae of predaceous fungi such as Tridentaria implicans and Trisporina aphanopaga Drechs. are weakly parasitic, indicating a loss of effectiveness and competitiveness.

Survey & Detection: In a population of infected nematodes, struggling prey will be attached directly to mostly nonseptate mycelium, usually with a yellow adhesive pad present. Complex structures, such as hyphal rings and knobs will be absent, and 3-dimensional networks are rare.

Table 1. Species of fungi that trap invertebrates using sticky hyphae and their prey preferences.

	SPECIES			
Genus	Attacking nematodes	Attacking rhizopods	Total in genus	Having known mucilaginous function
Acaulopage	0	23	29	26
Cystopage	cladospora Drechs.	3	7	6
	intercalaris Drechs.			
	lateralis			
Genicularia	perpasta R. C. Cooke	0	3	1
Monacrosporium	cianopagum	0	28	1
Stylopage	grandis Dudd.	8	14	10
	hadra Drechs.			
	leiohypha Drechs.			
Trisporina	aphanopaga Drechs.	0	1	1
Tridentaria	implicans	2	3	1
Zoopage	0	11	11	10
Totals	10	47	96	56

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